Economic and Financial Review

Volume 32 | Number 4 Article 3

12-1-1994

Cost-benefit analysis of captive power generation by manufacturing industries in Nigeria by G. K. Ajayi - a review

Okorie A. Uchendu

CBN ECONOMIC AND FINANCIAL REVIEW, VOL. 32, NO. 4 458–461

COMMUNICATION/REVIEW

COST-BENEFIT ANALYSIS OF CAPTIVE POWER GENERATION BY MANUFACTURING INDUSTRIES IN NIGERIA BY DR. G.K. AJAYI: A REVIEW

I. INTRODUCTION

The problem of electricity outages and supply inadequacies in Nigeria, and the accompanying economic losses have been well commented on in popular press and documented in professional journals.[1] The study that is being reviewed is a doctoral dissertation providing yet another concrete evidence of the loss arising from the inefficient electricity supply by NEPA. The focus this time is on the analysis of captive generation by manufacturing firms in Nigeria using the technique of cost and benefit analysis. Captive generation is the electricity produced by individual consumers mainly for their personal consumption. This review follows the five part presentation format of the study, namely General Introduction, General Supply – Demand Situation of Electricity in Nigeria, Cost-Benefit Analysis, Cost-Benefit Analysis of Captive Generation and Summary and Policy Implications. A comment concludes the review.

II. SUMMARY OF STUDY

Chapter 1 introduces the concept and importance of infrastructure in economic development. Electric power, which is publicly provided in Nigeria, is shown to be inadequately supplied. In response, many consumers provide their own electricity through captive generation. The Chapter also states the central theme of the study which is basically that the benefits of auto generation outweights the high investment costs. The literature review on industrial demand for electricity, methodology for the study and sources of data concluded the chapter.

Chapter 2 examines the demand for and supply of electricity in Nigeria and identifies low connection rate, suppressed demand, high level of illegal connections, high number of residential consumers and low per-capita consumption of electricity as the main features. Other peculiarities of the system are frequent and long power outages and build-up of captive capacity to forestall the resultant economic losses. The author suggests that empirical estimates of demand for electricity in Nigeria could be between 30 - 35 per cent of the actual needs of the total population. When compared to the demand for electricity in other countries and the widening gap between electricity demand and supply in Nigeria, the potential for captive generation of electricity, especially by manufacturing firms,

1 See, for instance, O.A. Uchendu: "Economic Cost of Electricity Outages: Evidence from a Sample Study of Industrial and Commercial Firms in the Lagos Area of Nigeria". CBN Economic and Financial Review, Vol. 31, No. 3, September 1993, pp. 183 - 195

are enormous. The supply of electricity in Nigeria was traced to 1886 when the colonial government installed generators with total capacity of 60 kilowatts in the city of Lagos. Later on, the Electricity Corporation of Nigeria (ECN), established in 1951, and three private firms – the Nigerian Electricity Supply Company (NESCO) in Jos, African Timber and Plywood Limited in Sapele and Shell B.P formed the initial electricity supply network in Nigeria. By 1972, the National Dam Authority was merged with ECN to form National Electricity Power Authority (NEPA). NEPA's installed generating capacity grew from 1,368.8 GWH in 1970 to 13,545.6 GWH in 1990 and made up of thermal and hydro plants. Despite the growth in capacity, the chapter shows that power supply deficiencies persisted and even worsened due to low system availability (generation, transmission and distribution). The factors identified here which could have caused NEPA's electricity supply problems are technological, regulatory, financial, administrative and personnel related. The rest of the chapter covers detailed account of the operations of NEPA.

Chapter 3 discussed the concept of cost-benefit analysis and its use as an analytical tool in investment decision. In general, the decision criterion is that the benefits of a project should exceed its cost for it to be a bankable project. The objective function is formulated in such a way as to either maximise the benefits accruing from the project subject to the cost or minimizing cost with respect to the stream of benefits from the investment. The investment criteria developed in the chapter are simple rate of return, pay-back period, net present value (NPV), and internal rate of return (IRR). The simple rate of return method accepts a project for implementation if the ratio of the net profit in a normal or best year to the initial investment is greater than the market interest rate while the pay-back period is expected to be low. Similarly, the NPV criterion selects a project in which the present value of its gross benefits exceeds the discounted gross costs. According to the IRR rule, a project's IRR must exceed its predetermined discount rate for its selection. The chapter also differentiates between project financial and economic rates of return. The basic difference is that the financial rate of return lays emphasis on profitability of the project while the economic rate of return additionally takes into account externalities to the project. An in depth derivation of shadow prices and the discount rate for project analysis are also presented in the chapter.

The main subject of the study (cost-benefit analysis of captive generation) is presented in chapter 4. The chapter starts with sources of data – primary data from a sample survey and secondary, and develops an econometric model of embedded production functions. The cost function has a translog specification. The chapter shows that 165 of the 179 manufacturing firms sampled (92.2 per cent) have their own sources for generating electricity which they use for 25 per cent and more of their production time. They rely on NEPA for the remaining time. The production function for captive generation of electricity assumed a Cobb-Douglas functional form where the quantity of labour needed to operate the generating sets, the market value of capital equipments and related costs, and fuel and lubricants are the explanatory factors. The estimation results show that the independent variables are

significant in explaining the variation in captive power generation which also exhibits increasing returns to scale. The translog cost estimates are also significantly and negatively related to electricity output. The survey results show that average cost of captive electricity is much higher than NEPA's tariff. Section 4.4 discusses the benefits of captive generation as comprising avoided loss of production, damage to production machinery and equipment, raw materials and goods in process, and payment for idle labour. The economic net present value (ENPV) and internal rate of return computations based on the benefit and cost streams in Section 4.5 show that captive generation is profitable to the sample manufacturing firms, while the ENPV and ERR show that the economy also benefits from captive generation. The Chapter concludes that despite the profitability of captive power generation, it is a second best solution to an efficient source of power from NEPA since NEPA is the cheapest producer of electricity in the country.

Finally, chapter 5 summarizes the findings of the study and points out their policy implications. The main findings of the study include: (i) financial, administrative and legal constraints of NEPA which have limited its operations; (ii) substantial investments in captive generation by manufacturing firms in response to inefficient NEPA supply; (iii) higher average cost of power produced by captive generation when compared to NEPA's tariff; (iv) recovery of 25 per cent of manufacturing output that could have been lost due to power outages; (v) net benefit in captive generation even though supply from NEPA is still the best option. The study suggests that either NEPA improves its performance or the regulatory framework for electric power production in Nigeria be modified to encourage competition.

III. COMMENTS AND CONCLUSION

The study is very comprehensive and educative. The theoretical issues were thoroughly discussed. The study also contains a good history of electricity development in Nigeria including the operations of NEPA. The efforts made to translate the abstract issues on cost-benefit analysis to quantifiable and measurable concepts are commendable. Some of the findings of the study have been corroborated by a study by the author (see footnote 1). While consumers would gain by purchasing electricity from NEPA as the results show, the need for the aur to highlight some of the underlying factors (high government subsidy on NEPA's operations, and by implication, tariffs; possible economies of scale advantage by NEPA) behind the apparent difference in cost. Also, the inclusion of NEPA's system losses (technical and non-technical) in the derivation of the tariffs would bring out some of the omitted economic costs. Finally, the study did not discuss the implications of risk and uncertainty on the profitability of captive generation. It is well known that risk and uncertainty do affect the actual outcome of a project which had been previously determined to be profitable.[2] This could be another area of research on this topic.

In conclusion, the major striking inference from the review of the study is that

2 See, for instance, J. Price Gittinger, Economic Analysis of Agricultural Projects, 1984, The John Hopkins University Press, Baltimore, page 9.

there is a need to minimize the incidence of captive power generation despite its discovered profitability. As long as the cost of captive power generation is higher than NEPA's tariff, it pays the country to assist NEPA to overcome its problems. This will improve the efficiency of the agency, minimize captive power generation and reduce production costs in the manufacturing industry. An important corollary of this finding is that the commercialization policy of NEPA should be vigorously pursued. In order to enable NEPA overcome its technological problems, there is a need to allow foreign investment from reputable companies. This will also be in line with the recommendation of the study.

Dr. Okorie A. Uchendu
Principal Economist
Research Department
Central Bank of Nigeria